REMARKS

This is in response to the non-final Official Action currently outstanding with regard to the above-identified application.

Claims 26-43 were pending at the time of the issuance of the currently outstanding Official Action. As a result of Applicants' election with traverse in response to the Examiner's requirement for Restriction, Claim 36 has been withdrawn from further consideration as being directed to a non-elected invention. However, as a result of the Examiner's reconsideration of his restriction requirement, Claims 26-35 and 37-43 have been considered on their substantive merits in the currently outstanding Official Action. Accordingly, Applicants believe that the Examiner's indication in the currently outstanding Office Action Summary to the effect that Claims 33-36 are subject to a restriction and/or election requirement is in error. In order to conform with the text of the currently outstanding Official Action, the Office Action Summary should have indicated that Claims 26-43 are pending, Claim 36 is withdrawn from further consideration, and Claims 26-35 and 37-43 are rejected.

By the foregoing Amendment, no claims have been added and no claims have been canceled. Claims 26, 27, 28, 30, 32, 33, 37, 38 and 39 have been amended, but no new matter has been added to this application by virtue of the foregoing amendments. Accordingly, upon the entry of the foregoing Amendment, Claims 26-35 and 37-43 will constitute the claims under active prosecution in this application.

The claims of this application along with appropriate status identifiers for each are set forth hereinabove as required by the Rules.

In the currently outstanding Official Action, the Examiner has:

1. Failed to acknowledge Applicant's claim for foreign priority under 35 USC 119 (a) – (d) or (f), and failed to confirm the receipt by the United States Patent and Trademark Office of the required certified copies of the priority document – **an appropriate acknowledgement of Applicants' claim for foreign priority and the receipt of the required copy of the priority document for this application by the United States Patent and Trademark Office in response to this communication is respectfully requested;**

2. Objected to the Drawings on the grounds that Figures 7 and 8 should be designated by a legend such as -- PRIOR ART -- since only that which is admitted to be old is shown therein – **Applicant herewith has included a Request for Drawing Change Approval including the attached photocopies of Figures 7 and 8 showing the proposed changes in red which adopts the Examiner's suggestion for the addition of the legend -- PRIOR ART – to Figures 7 and 8, and concurrently herewith has submitted a new set of formal drawings incorporating those changes – acceptance of Applicant's proposed drawing changes and the entry of the new set of formal drawings submitted concurrently herewith is respectfully requested in response to this communication;**

3. Provided Applicants with a copy of the Form PTO-1449 filed with their Information Disclosure Statement of February 7, 2001duly signed, dated and initialed by the Examiner to confirm his consideration of the art listed therein;

4. Provided Applicants with a copy of a Form PTO-892 and a copy of the references cited therein;

5. Acknowledged Applicants' Response to his previous Restriction Requirement ***with traverse***; and indicated that upon reconsideration Claim 36 would not be examined on its substantive merits, but that Claims 26-35 and 37-43 would be examined on their substantive merits;

6. Rejected Claims 26-28 and 32 under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants' regard as their invention in that the word "type" used therein is a relative term that renders those claims indefinite – **Applicants respectfully note that the same terminology appears in others of the claims than those mentioned by the Examiner in this rejection and that the phraseology including "angle-diversity type" has been change by the foregoing Amendment so as to specify an "angle-diversity receiver" – withdrawal of this rejection in view of the foregoing Amendment in response to this communication, therefore, is respectfully requested;**

7. Rejected Claims 26-28, 30-32, 37, 38, 40, 41 and 43 under 35 USC 103(a) as being unpatentable over the Welch et al reference (US Patent 5,903,373) in view of the Ota et al reference (US Patent 5,986,373);

8. Rejected Claims 33-35 under 35 USC 103(a) as beingunpatentable over the Welch et al reference (US Patent 5,903,373) in view of the Ota et al reference (US Patent 5,986,373) as applied to Claim 32 further in view of the Knapp reference (US Patent 4,975,926) and the Sumi et al reference (US Patent 4,536,057);

9. Indicated that Claims 29, 39 and 42 are objected to as being dependent upon rejected base claims, but that those claims would be allowable if rewritten in independent form including all of the limitations of their respective base claims and any intervening claims; and

10. Cited several further patents as being pertinent to Applicants' disclosure, but failed to apply any of those patents against the claims of this application.

Further comment in these Remarks concerning items 1-6 and 10 is not deemed to be required.

With respect to items 7-9 above, Applicants have the following comments.

Applicant respectfully submits that the Examiner has not fully understood the distinctions between the space-division multiplexing of the present invention and the space division combined with multiplexing in time domains disclosed in the cited and applied references.

Hence, the Examiner has argued that the Welch reference discloses a base station for use in a space-division multiplex optical wireless network. Applicant respectfully disagrees. In particular, Applicant respectfully submits that while the Welch reference discloses is space division, it does not disclose communication channels multiplexed in terms of space.

Multiplexing generally means that a plurality of terminals can perform the communication at the same time by using a plurality of channels. Multiplexing by space-division (the present invention) and multiplexing in time domains (Welch), however, are totally different from one another.

Therefore, it will be seen that in Welch, because of the structure (for example, an arrangement of detectors in the case of a receiver), there is only a spatial communication channel implemented irrespective of whether space-division is performed or not. Specifically, in the Welch reference, multiplexing of a channel for handling a plurality of terminals is performed in a time series. This is readily apparent from the features described in the Welch reference indicating that polling of a channel is performed, and an uplink and a downlink are arranged in a time series within a single frame as shown in Fig. 3 so as to be shared among a plurality of remote terminals as shown in Fig. 6. Consequently, in the Welch reference, the number of remote terminals that can exchange information with a base station at a certain time without an error is always at the maximum one.

In principal, the foregoing does not change. That is to say that since multiplexing is performed in a time domain in Welch, it is obvious that a communication protocol is limited as set forth above. On the other hand, however, in a plurality of space-division multiplexed channels such as in the present invention, each of the space channels is substantially the same as a one-to-one communication channel with a base station for a remote terminal. Accordingly, in the present invention unlike Welch, full use of a communication band of the remote terminal can be made. Similarly, the present invention provides the advantage that a number that equals the number of channels can perform communications in parallel at the same time.

The Examiner further asserts that (1) the remote terminal of Welch comprises a receiver of an angle diversity type (Fig. 11) and a multi-beam transmitter for outputting a plurality of beams (Fig. 10), (2) the Welch base station comprises a multi-beam transmitter for outputting a plurality of beams (Fig. 14), and (3) the Welch multi-beam transmitter includes a plurality of transmitters that each include at least one LD or LED as a light source. (Note: Figs. 10 and 11 of Welch show a remote terminal, not a base station. These showings, however, are regarded as the same herein for explanation purposes because such a remote terminal can be applied to the base station in the context of the present invention.)

Space-division in Welch only performs angle diversity for the purpose of improving the SNR of a channel. Thus, it will be seen that in the receiver side, parallel reception signals outputted from a plurality of detectors 109 or 135 as shown in Figs. 11 or 14 of Welch are the same transmission signals that are received from only one terminal which have been sent out by a communication protocol in a manner calculated to avoid collisions between (among) a plurality of transmission data. Thus, those signals are different only with respect to their SNR or an influence of multi-path reflection. Thereafter, one of the plurality of reception signals in Welch is selected or the signals are combined. In either case, however, there is only one spatial communication channel.

In the present invention, on the other hand, each remote terminal substantially performs one-to-one communication with a base station. Therefore, in the present invention, it is not necessary to utilize a specific inherent communication protocol as prepared by Welch for achieving a multiple connection. In addition, the disadvantage that the communication band of the remote terminal is not fully utilized does not occur. Instead, a concept of a space cell for multiplexing is provided. Further, when the space cell concept for multiplexing is used, a dead zone boundary region between the space cells becomes an essentially important technical problem, and the structure of the base station becomes an important technical key to its solution.

It is to be understood in the latter regard that in Welch the whole space is logically a single space cell, and this remains true irrespective of whether space-division is performed by Welch or not. In Welch, the single space cell is shared by a plurality of remote terminals in accordance with a communication protocol. For this reason, in Welch, there is no concept or recognition of a space cell as an individual channel that is spatially multiplexed, so there is no need to provide a system with a boundary between spatially divided regions.

Actually, as shown in Figs. 10 and 11 of Welch, space-divisions for transmission and reception do not have to correspond to each other at all. It is sufficient if a wide angle region is covered as a whole. Nevertheless, in the base station of Welch as shown in Fig. 14, the space is divided in three directions in order to divide transmission/reception. In this case, however, as shown in Fig. 21 (and at "AVERAGING DIVIDE BY THREE" in the circuit diagram of Fig. 15) these three signals are the same transmission data that are received from only one terminal, which have been sent out using the transmission protocol used to avoid transmission data collisions. Thus, they are difference only in terms of SNR or an influence of multi-path reflection.

Since the plurality of reception signals are combined and one space cell of the whole space exists, the latter is no different in terms of the form of communication than one space cell that is shared by a plurality of remote terminals by a protocol. Hence, in both the multi-beam transmitter and the angle diversity type receiver there is a decisive difference in a channel between diversity by space division and space-division multiplexing.

The Examiner also asserts that Ota discloses a concept of a space cell in Figs. 22 and 23 such that the present invention would have been obvious over the combination of Welch and Ota. (These figures, similarly to Figs. 10 and 11 of Welch, illustrate a transmitter/receiver of the remote terminal. They are regarded as the same herein for explanation purposes since such a remote terminal can be applied to the base station of the present application.)

In Ota, as shown in Fig. 22B and Col. 16, lines 9-12, one of seven cells is selected by manipulating the lens 175 during either transmission or reception. This means that only one spatial channel is formed, and indicates that it is impossible to cause them to operate independently. Consequently, as described by Ota at Col. 16, line 62 to Col. 17, line 11, with respect to the vertical direction, that reference tries to reduce the transmission power of remote terminals by using spatial diversity rather than by the provision of space-division multiplexing. In addition, at Col. 17, lines 11-13 with respect to a horizontal direction, Ota makes it evident that the remote terminal itself determines the timing of the handover between spatial cells provided by different base stations 121a and 121b by the use of spatial diversity. This is another indication that Ota does not assume the multiplexing of channels by space division in a single communication area.

Accordingly, Applicant respectfully submits that with regard to the difference between space division and space-division multiplexing, Welch and Ota are in the same category. Hence, even though the system of Welch is improved in comparison to the system of Ota, the same space-division multiplexing system as that of the present invention cannot be achieved by either of them. Neither the system of Ota, nor the system of Welch, provides for space-division multiplexing at least on the following two points:

First, as shown by Fig. 23 of Ota, in the Ota reference there are a plurality of transmission/receiving elements into the number of which the communication area is spatially divided. Thus, as described at Col. 15, lines 64-66, only one transmitting element 173 or receiving element 174 corresponds to one of the space cells, and it has a single light emitting element such as an LED or an LD or a single PIN-PD. In other words, the concept of assigning one or more light emitting elements or light receiving elements for grouping is not disclosed.

On the other hand, however, it is a feature of the base station of the present invention that there are at least one or more elements for each of the space cells. Specifically, for example, in the present invention there would be one or more of the transmitting elements 173 and of the receiving elements 174 for each of the space cells 112a-g shown in Fig, 24 of Ota. The total number of groups of transmitting/receiving elements is the number of space cells that can be independently operated in parallel in the present invention. It will be understood that the above-described differences are based on whether the system is provided for space-division multiplexing or not, and lead to the generation of a decisive difference regarding space resolution.

As shown in Fig. 23 of Ota, there is an excessive dead zone between the elements 173 and 174. The dead zone thus generated in space between the space cells formed by these elements cannot be used for communication. This is not the only problem, however. A more serious problem tends to occur when the space cells actually formed in the space overlap excessively. In the latter case, when space multiplexing is performed (adjacent cells are operated in parallel) co-channel interference (CCI) inevitably occurs. This problem is not addressed by either Ota or Welch. This is because in those systems, one of the space cells is selected or a plurality of the signals are the same signals that may be combined into one. Accordingly, in either Ota or Welch or in either a transmitter or a receiver only a diversity gain by space-division is utilized.

On the other hand, a major problem addressed by the present invention is the sufficient suppression of co-channel interference specific to the space-division multiplexing system. Such may not be a problem in a system that only performs spatial diversity. Other problems addressed by the present invention include the maintenance of a high throughput without burdening the remote terminals, and the implementation of the whole system at low cost.

Therefore, it will be seen that in the present invention, multiplexing of channels by space-division is a prerequisite. The logical consequence of this is that the problems to be solved by the present invention in comparison the Ota and Welch references are quite different. One such problem is represented by the term "predetermined size" used with the term "space-division multiplexing" as in Claim 26 of the present application.

The Examiner suggests that Ota discloses the concept of a space cell in Figure 22B and that the control of the size of that space cell is merely a matter of design choice achieved by such expedients as increasing the number of transmitters and enhancing transmission light power.

In the latter regard, however, it should be recognized that it may be necessary to individually control directions of axes of the respective space cells, i.e., angles of optical axes of the respective transmitting/receiving elements only if it is assumed that a plurality of the space cells operate in parallel. This can be readily understood from the fact that the basic objective of space-division multiplexing is to accommodate only one remote terminal (or one user) in one space cell. More particularly, the size of the respective cells produced by the base stations should be uniform across the entire area covered by the base stations.

In order to meet this system requirement that is inevitable for space-division multiplexing systems, controlling the axis directions of the space cells is an essential feature. On the other hand, however, in a system in which only spatial diversity is an objective, it is not necessary to finely control the angles of the axes of the transmitting/receiving elements. Rather, it is sufficient if the system is designed to perform space-division (in the most simple case, equal division) in an angle region and to simply maximize the transmission power to individually divided space cells. This is closely related to the fact that Welch and Ota do not describe the diameter of the space cell because that diameter does not have to be defined in the systems disclosed by them.

Regarding Claims 27 and 28, the Examiner argues that by combining Welch and Ota it would have been obvious to set different directions and angles of divergence between each transmitter of the multi-beam transmitter. However, the technical background of the present application is different from the Welch and Ota references even with respect to the necessity of controlling directions to which the spatial cells are oriented. This requirement is different from the necessity of controlling directionality (half angles of divergence) of each of the beams.

Specifically, in order to implement a practically useful space-division multiplex system, first, the size of the actually formed space cell should be defined by setting the axis direction of the space cells that is assumed as the scene of use. Then, the directionality of each of the beams of the multi-beam transmitters should be controlled with respect to the space cells to sufficiently suppress the co-channel interference (CCI) of space-division multiplexed downlink channels.

On the other hand, however, in a system in which only spatial diversity is an objective, it is not required to take into consideration the generation of dead zone due to co-channel interference by receiving a plurality of different signals near the boundary regions between the divided cells. Therefore, it is sufficient if the system is designed to perform simple space division in the angular region and to simply maximize the transmission light power to the individually divided space cells.

It will be understood in light of the foregoing that in a communication system of a space-division multiplexing type, in order to solve the specific problems when the channel is space-division multiplexed, axes of the representative space cells, i.e., optical axes of the transmission space cells formed by the beams of the multi-bream transmitter and optical axes of the receiving space cells formed by the angular diversity type receivers (naturally, these should match as pairs in the respective space cells), have to be defined so as to conform to a predetermined space cell arrangement.

In addition, in order to suppress co-channel interference of downlinks (communication from a base station to a remote terminal), the degree of directionality, i.e., half value angle, should be controlled. The optimum value thereof depends on the setting of the axial directions of the respective space cells. This is not described in either Welch or Ota, but is discussed in the present specification. Still further, the space resolution of an angle-diversity type receiver in a base station is also important for suppressing co-channel interference of uplinks (communication from a remote terminal to a base station.

With respect to Claims 30, 37, and 38, the Examiner indicates that Fig. 22B of Ota discloses a structure in which a base station receiver including a lens dedicated for reception is composed of a plurality of segments that are capable of outputting signals individually.

The relationship referred to by the Examiner can be readily understood by comparing a pair of (a) and (c) and a pair of (b) and (d) in Fig. 8 of the present application. Thus, assume that both structures (a) and (b) of Fig. 8 perform three space-division multiplexing operations in a certain angle direction, similar to that shown in (c) of Fig. 8. In such a case, in the structure of the angle-diversity type receiver of (b) of Fig. 8, there are three detector outputs for each angle range divided into three, i.e., nine detector outputs in total. Thus, the spatial resolution of each of the detectors is three times that of the divided space cells. By selecting the one having a maximum SNR out of the three detector outputs corresponding to one space cell, or combining the outputs to generate one output, an output that is independently operable can be obtained for each of the three space cells.

On the other hand, in the structure of the angle diversity type receiver of (a) of Fig. 8, there is one detector output for each of the three divided angle ranges, and the scope of the resolutions of the respective detectors are equal to those of the divided space cells (of course, if the total number of the space channels is small, even this structure can be used as a space-division multiplexing system by retrieving three independent outputs for three space cells). At the same time, the structure corresponds to that shown on the right hand side of Fig. 22 of Ota. However, in the case of Ota, space diversity is performed by selecting one having the maximum SNR out of three outputs obtained for the entire space, or combining them to generate only one output. The structure shown in Fig. 14 of Welch also corresponds to the latter structure. As described at Col. 13, lines 53-55 of Welch, a single output can be obtained from a set of a plurality of detectors having the same optical axis that are arranged in parallel as an array. However, as described at Col. 8, lines 31-38 of Welch, it merely forms a single omnidirectional space channel as a transmitter/receiver the same as disclosed by Ota.

In view of the foregoing discussion, Applicant respectfully submits that the differences between the diversity by simple space division and multiplexing of channels by space-division are significant. It also is clear that the angle diversity type receiver of the base station of the present invention should have a resolution higher than those of the predetermined space cells in order to adequately receive an uplink signal which is output from a remote terminal near the boundary between the adjacent space cells as an accurately separated space-division multiplexed channel in the base station receiver.

With respect to Claims 31, 40, 41 and 43, the Examiner argues that Welch and Ota do not clearly show that the radius of a space cell is from 20 to 100 cm, but since this is merely a matter of design choice and can be attributed to a number of known devices, it would have been obvious to those skilled in the art.

In this regard, the difference between spatial diversity by space division and multiplexing of channels by space division plays an important role. As described above, in the case of simple spatial diversity, space-division usually is performed in an angle region. For example, as described in Col. 13, lines 13-24 of Welch, arrays consisting of four detectors are mounted with 0 degree, +45 degree and –45 degree slants so as to perform three space divisions. This manner of space division does not depend on the minimum or the maximum communication distance assumed by the system and should always be mounted at 0 degree, at +45 degree and at –45 degree. Further, in this manner of space division of an angle region, the size of the space cell usually is considerably larger than that of the space cell assumed in the present application. Hence, the cost benefit that is achieved by the present application cannot be obtained when the system just mentioned is applied to the space-division multiplexing system.

On the other hand, in the space-division multiplexing of the present invention, it is desirable to define the size of the space cell in terms of a distance, i.e., as a radius equal to the distance between a base station and a terminal between which communication is to be frequently performed, not an angle region. Thus, a desirable form of the space-division multiplexing system of the present invention accommodates only one remote terminal (or one user) in one space cell so as to obtain maximum throughput without burdening the remote terminals with a complicated protocol processing function. In other words, it is desirable in the present invention that the size of the respective space cells generated by a base station is within an appropriate range in which an individual user carrying the remote terminal may exist. In a setting such as a small office wherein a range of the maximum communication distance (distance between a base station and a terminal) of about 1 to 5 m is assumed for accommodating a normal IrDa mounted terminal, the optimum space cell radius generally should be limited to 20 to 100 cm. This is an important feature that is specifically recognized in the above-described problem to be solved of the present invention, i.e., space-division multiplexing for incorporating an optical wireless network while alleviating the burden on a remote terminal and maintaining a high throughput is maintained with low cost.

Further, with respect to cell size, important teachings concerning the structure of an optical wireless system of a space-division multiplexing type are found in the prior art documents cited in the specification of the present application. Specifically, in prior optical wireless systems performing space-division multiplexing, for both transmitters and receivers of angle diversity type in the base station, monolithic semiconductor arrays were used as light source elements and light receiving elements.

In addition, imaging by a lens system was performed to significantly increase the space resolution of the respective transmitting and receiving elements. This was particularly the case when a multi-beam transmitter was formed in a base station transmission system using monolithic semiconductor elements in which planar light emitting lasers or LEDs were arranged in arrays, and a lens system common to all the light emitting elements was provided such that the angles formed by respective light emitting elements were in a very narrow and acute pattern. For covering an area of a significant breadth, the number of the array elements sharply increases and the size of a die became extremely large. In this situation, since the die is an expensive compound semiconductor, it directly led to undesirable increases in the cost of the base station.

In order to implement a space-division multiplexing system at reasonable cost, therefore, it is essential that, in the base station transmission system, a multi-beam transmitter is formed of discrete light emitting elements (see Fig. 1, 102 of the present application). Also, it is essential that monolithic photodiode arrays are provided on a focal plane of the lens system in the base station receiving system to implement a high space resolution (see Fig. 1, 102 of the present application). These requirements to Applicant's knowledge are disclosed for the first time by the present application.

With respect to the features of the remote terminal to be incorporated into the space-division multiplexing system of the present application (Claims 33, 34 and 35), the Examiner has alleged that Claims 33, 34 and 35 would have been obvious over Knapp and Sumi in view of Welch and Ota.

More particularly, regarding Claim 33, the Examiner admits that Welch and Ota do not disclose a structure including an optical filter which can be easily attached and detached and which can attenuate a specific light transmitted by the terminal. However, the Examiner asserts that Knap discloses a structure in which an optical filter for attenuating a background light other than a signal light is incorporated into a lens system of a base station receiver while conceding that means for attaching and detaching the optical filter is not described in that reference. To supply the missing element, the Examiner relies on the Sumi reference that he asserts discloses means for attaching and detaching the optical filter (in a camera lens assembly).

In the latter regards it is to be noted that, in the present application: 1) one of the disclosed objects is to include an optical filter in a remote terminal; and 2) the light which should be selectively attenuated by the optical filter is transmission signal light of the terminal itself, not the background light or light of a signal transmitted from other terminals or base stations. This means that to remove background light or other noise light by the filter in a receiver of a remote terminal to improve SNR of a signal is totally different from the objective of Claim 33 of the present application. The optical filter that is desired to be included in a remote terminal in the present application is an optical filter useful for full-duplexing of an access when the remote terminal accesses the space-division multiplexing network via a base station as disclosed in the present application (of course, an effect of removing background light may be included as a secondary effect).

In the present invention, a main remote terminal is contemplated to be a small remote terminal with a less functionality and low cost. This remote terminal should perform half-duplexing intrinsically and should be capable of being carried by a user. For example, an existing IrDA terminal, is assumed in the present specification.

Further, since the transceiver in a remote terminal of the sort just discussed is extremely small, there often is a problem in that diffraction of the transmitted light of itself to a receiver is generated and the time for recovery of saturation of the receiving circuit cannot be reduced. On the other hand, in Ota all of Figs. 10, 14 and 22 show a light shielding pipe 108 or a partition board 104 provided between transmitting and receiving elements that form a pair. It can be easily understood from this showing that only full-duplex communication is assumed. Further, to provide the plurality of transmitters/receivers disclosed in Ota (or Welch) or a complicated processing capacity to the remote terminal assumed in the present application completely deviates from the objective of the present application.

Even a remote terminal such as the one described above which has been widely used as a low cost communication link, can be full-duplexed and incorporated into the space-division multiplexing system of the present invention without adding any substantial modification to the existing communication protocol by including the filter of Claim 33. Thus, it is possible to make full use of the effect of multiple connections by space-division multiplexing of the present application.

When remote terminals individually communicate with each other, even the remote terminal assumed in the present application may be limited to half-duplex communication that is intrinsically carried out. Conversely, however, it also can be said that an essential requirement of the present invention is to enable communication among similar remote terminals which are not manufactured for participation into the space-division multiplex system of the present invention. Accordingly, as described in Claim 33, by providing means for attaching and detaching the filter, the above-described objective can be achieved.

Also, even though it has been known since before Knapp that an optical filter can attenuate light of a specific wavelength by its design, and prior to Sumi it was known that not only a camera lens but also a filter portion could be made mechanically movable, Applicant nevertheless respectfully submits that Claim 33 is patentable over the prior art as a portable terminal including an existing communication interface which performs a simple LOS communication that also can be incorporated into the space-division multiplexing system of the present invention without a significant modification to the protocol or increase in a processing load.

With respect to Claims 34 and 35, the Examiner asserts that the system disclosed by Ota includes a transmitter having a plurality of light sources and a signal intensity multiplexer that is used for selecting or detecting a signal having a sufficient intensity from spectrum components.

To the extent that the Examiner's argument relates to the difference between the diversity by space-division and space-division multiplexing it has been discussed in detail above. However, it should be noted that the features of the base station recited in Claims 34 and 35 of the present application relate to duplexing that is totally different from what has been discussed above. Specifically, for the purpose of full-duplexing and incorporating an existing remote terminal at low cost and a low level of complexity into a space division multiplexing system, desirable requirements for the base station transmitter of the present application are disclosed in Claims 34 and 35 of the present application in order to obtain the feature of the remote terminal of claim 33 of the present application to cut a wavelength band used by each of the remote terminals, i.e., the feature that the receiver of the remote terminal cuts a wavelength band of a transmission light thereof.

The system of Ota is only provided for full-duplex communication. Further, the feature of the present invention that relates to switching between full-duplex or half-duplex methods also is not described in Ota. Only the spatial diversity by selecting a channel having a strong signal intensity is described in the Ota reference. Therefore, Applicant respectfully submits that no relationship can be found between Claims 34 and 35 of the present invention and the Examiner's last stated characterization of the Ota reference.

On the other hand, corresponding to Figs. 3, 4 and 5 of the present application, the wavelength band used by a base station transmitter and a wavelength band used by a terminal (wavelength band used by a terminal transmitter and a wavelength band cut by the filter of Claim 33) may be in various combinations depending on which LEDs or LDs are mounted on the respective transmitters of the base station and the remote terminals. Accordingly, the features of the base station of Claim 34 indicate that a wavelength band of any of the light sources of the multi-beam transmitter of the base station transmitter should include a spectrum component having a sufficient intensity different from those of the wavelength bands of the respective terminals disclosed in Claim 33. Thus, even when the remote terminal includes a filter for full-duplexing, a downlink from a base station to a remote terminal becomes always receivable and the full-duplex operation at the remote terminal is made possible. The case in which an LD is used for a base station as described with respect to Fig. 3, for example, may be a preferable example.

The features of the base station of Claim 35 also indicate that a wavelength band of any of the light sources of the multi-beam transmitter of the base station transmitter may include any of the wavelength bands of the respective terminals disclosed in Claim 33 as long as it includes other spectrum components at a sufficient intensity. Thus, even when the remote terminal includes a filter for full-duplexing, a downlink from a base station to a remote terminal becomes always receivable and the full-duplex operation at the remote terminal is made possible. For example, the case in which various LEDs are used in the base stations with respect to Fig. 4 may be a preferable example.

In either of the latter two cases, in the space-division multiplexing system of the present application, multiplexing of the channels is performed by space-division. For the reasons discussed above, Applicant respectfully submits that Claims 34 and 35 are patentable based on the point that the feature of the base station for enabling a portable terminal, which comprises an existing communication interface for performing simple LOS communication, to be incorporated into the space-division multiplexing system of the present application without a significant protocol modification and an increase in processing load is disclosed.

For each and all of the foregoing reasons and in light of the foregoing Amendment, Applicant respectfully submits that once the distinctions between space-division multiplexing on the one hand and space division with time domain multiplexing on the other hand along with the ramifications of each as discussed above are understood, it is clear that the Examiner's currently outstanding rejections should be withdrawn, and that the claims pending upon the entry of the foregoing Amendment, Claims 26-35 and 37-43, are in condition for allowance. A decision so holding in response to this communication is respectfully requested.

Finally, Applicants believe that additional fees are not required in connection with the consideration of this response to the currently outstanding Official Action. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge and/or credit Deposit Account No. **04-1105**, as necessary, for the correct payment of all fees which may be due in connection with the filing and consideration of this communication.

Respectfully submitted,

Date: July 7, 2004

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FIG. 7 PRIOR ART

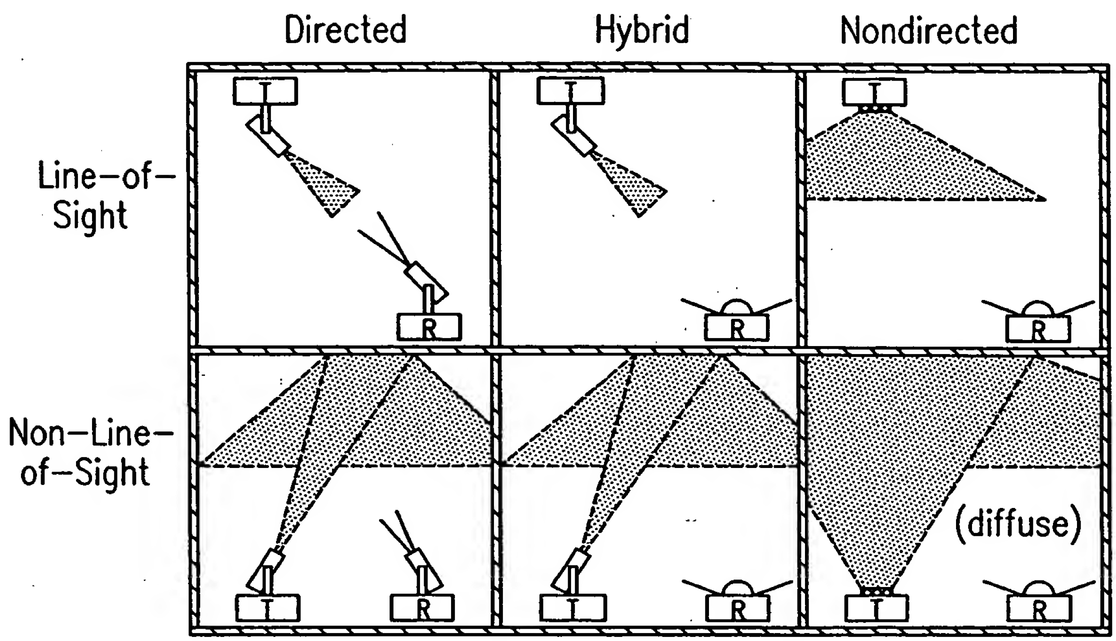

FIG. 8 PRIOR ART